UNIVERSITI TEKNOLOGI MARA

ASSESSMENT OF URANIUM, THORIUM AND POTASSIUM-40 IN KELANTAN RIVER BASIN

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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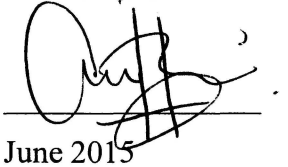
Signature of Student	:	
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ABSTRACT

Granitic rocks in the Kelantan State, contribute higher natural background activity than usual in environment because of it has characteristic of regions that were believed to produce significant concentrations of Naturally Occurring Radionuclides Material (NORMs) such as U and Th. Moreover, human activities such as deforestation and mineral mining in Kelantan were responsible for the NORMs mobility in the surrounding environment. Radiation from the NORMs may cause health risk to human health through the external and internal exposure. In this study, a radiological monitoring was done in the area where based on geological map of Kelantan containing uranium deposits. Soil, water and sediment were taken at 55 locations along the Kelantan river basin. As natural radionuclides that may present in the water, Water Quality Standard Malaysia introduces radium as one of the parameters that should be monitored. Radium in drinking water cannot exceed 0.1 Bq/L. Thus, 48 of aqueous samples, 25 L each, were collected along Kelantan River basin, acidify to pH 2 and filtered before the analysis. The extraction method was used to extract ^{222}Rn in aqueous samples. Measurements of activity concentration of ^{222}Rn were done using liquid scintillation counter (LSC) and were calculated to get the activity concentration of ^{226}Ra. The LSC was set up to the optimum discriminator level and counting was done using alpha-beta mode. The results show that activity concentration of ^{226}Ra range between 0.06 - 0.39 Bq/L for unfiltered samples and 0.06-0.37 Bq/L for filtered samples. The Annual Effective Dose is ranging from 13-80 μSv/y, however are still below the WHO recommended reference level of 100 μSv/y for river water. The radioisotopes may present in the water caused of geological erosion from the groundwater and dissolution of uranium-bearing rocks due to changing of temperature in the earth crust and also because of the erosion of the surface soils. Activity concentration of ^{226}Ra, ^{228}Ra and ^{40}K and concentration of U and Th were evaluated in sediment and soil. Sediment and soil was dried, ground, sieved and then measured using Gamma Spectrometer and X-ray Fluorescence. Activity concentrations of ^{226}Ra range between 378.1 - 579.7 Bq/kg, ^{228}Ra 431.6 - 847.2 Bq/kg and ^{40}K 5837.4-8421.2 Bq/kg in sediment. The calculated Hex range 4.5-6.3 and Absorbed Dose Rate is range between 690.6 -1089.9 nGy/h giving the highest exposure at Location 13.Activity concentrations of ^{226}Ra range between 41.1 - 369.4 Bq/kg, ^{228}Ra 49.7 - 390.6 Bq/kg and ^{40}K 486.8 - 2362.3 Bq/kg in soil. The H_{ex} is ranging from 0.4 to 2.9 and the Absorbed Dose Rate is ranging from 72.4-483.2 nGy/h. Concentration of U range from 1.31 - 9.41 mg/kg and concentration of Th range from 3.79 - 16.32 mg/kg. Based on the results of concentration of U and Th, prediction maps were plotted. It shows that the highest concentrations of U and Th are at the center of Kelantan state such as Jeli, Dabong and Kuala Krai. The area of Kota Bharu shows an accumulation of U and Th as river water flows from South to North. The prediction concentration of U and Th in an area of Gua Musang is lower than the other places. In conclusion, there were a significant amount of U and Th in Kelantan state.

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